IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Attorney Docket No.: 37945-0026

Applicant: Colin Stanley Fitchett

Appl. No.: 09/308,403 Examiner: Francisco Prats

Filing Date: October 21, 1999 Art Unit: 1651

Title: PRODUCTION OF VEGETABLE GELS

DECLARATION UNDER 37 CFR §1.132

Commissioner of Patents
Washington, D.C. 20231

Sir:

Attached is a copy of an original declaration under 37 CFR §1.132 in support of the amendment filed concurrently herewith.

US Patent Application Serial No. 09/308,403
(Colin Stanley FITCHETT)

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FIRST DECLARATION OF RODERICK GREENSHIELDS

I, Roderick Greenshields, a British citizen, of 4 Beaconsfield Court, Skewty, Swansea, West Glamorgan SA2 9JU, United Kingdom, declare and say that:

1. I am one of the inventors named on Greenshields *et al.* (US Patent 5,530,112) which has been cited by the US PTO Examiner against US Patent Application Serial No. 09/308,403 (hereafter called "US'403") in an Office Action mailed on March 15, 2002.

2. I have considerable experience in the technical field of plant-derived gels and I am intimately familiar with the techniques used for preparing hemicellulose extracts and gels therefrom, having worked in this area of technology for 25 years. This will be apparent from my *Curriculum vitae* which is attached as Appendix A.

3. I have reviewed the inventions disclosed in US'403 and Greenshields *et al.* I have also read and understood the objections raised against certain claims pending in US'403 in the US PTO Office Action dated mailed on March 15, 2002.

4. I have been asked to comment on the objections raised under 35 USC § 103 over Greenshields *et al.* in view of Crawford *et al.*. (US Patent 5,200,338) and over Maat *et al.* (US Patent 5,108,765) in view of Chemical Abstracts 79(5): 30641 (1973) ("Geissman"), which documents I have reviewed and understood.

A. The Teaching of Greenshields *et al.* and Crawford *et al.*

5. US'403 describes a water soluble, non-cellulosic, non-starch, hemicellulose-based composition containing a hemicellulose material that consists of at least one plant polysaccharide including arabinoxylan ferulate, an oxidase and an oxidase substrate. US'403 also discloses a method for performing oxidative gelation of the hemicellulose material, which method involves *in situ* generation of hydrogen peroxide by the oxidase and oxidase substrate.

6. Greenshields *et al.* describe the oxidative cross-linking of the phenolic compound ferulic acid (Fig. 1) which is associated with polysaccharides that are extracted from the cell walls of plants, including for example maize. The compounds in question are structural elements of the cell wall. The cross-linking results in a rigid, insoluble gel derived from the polymerisation of the polysaccharide. The new bonds produced are known to include ether bonds between the ferulic acid residues (Fig. 2).

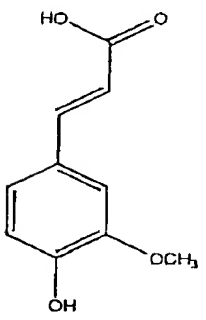

Fig. 1 Ferulic acid

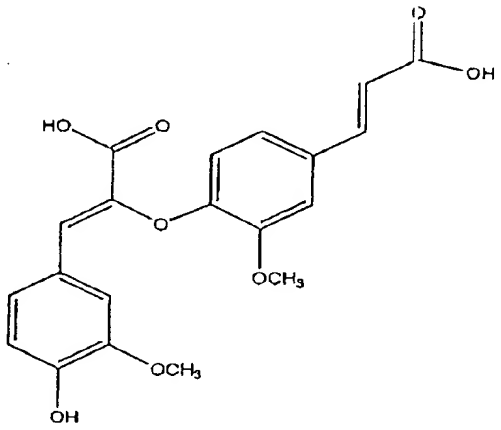

Fig. 2 A dimer of ferulic acid

7. The oxidation as described in Greenshields *et al.* is carried out at ambient temperature using added hydrogen peroxide and is catalysed by a peroxidase enzyme.

8. I and my co-inventor Artis Rees did not consider in Greenshields *et al.* achieving polymerisation using *in situ* generation of peroxide, partly as a result of the contrary teachings of Crawford *et al.* as discussed below.

9. Crawford *et al.* describe an oxidative process that is reported to depolymerise and solubilise phenolic compounds associated with polysaccharides extracted from the cell walls of plants, including for example maize. The compounds in question, lignins, are structural elements of the cell wall. Model compounds described in Crawford *et al.* (see compound I in Fig. 3 below) are remarkably similar to the ferulic acid dimers obtainable from Greenshields *et al.*

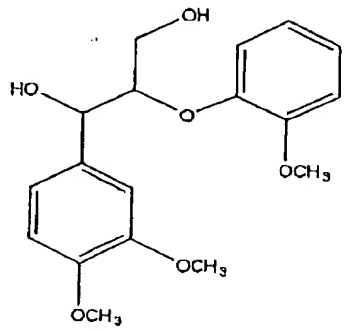

Fig. 3 Compound I – A typical lignin compound

10. Depolymerisation in Crawford *et al.* occurs through cleavage of ether bonds within the molecules. Crawford *et al.* describe an oxidation carried out by either the addition of peroxide or its generation *in situ* from the oxidation of glucose catalysed by glucose oxidase. Crawford did not teach or effect polymerisation reactions as a result of *in situ* generation of peroxide.

11. In US'403, polymerisation and gelling is achieved using *in situ* generation of peroxide. Compared with Crawford *et al.*, conditions for the reaction in US'403 typically involve reactions with about 20 times the level of glucose and 5000 times the level of glucose oxidase, although the reaction in US'403 is of a shorter duration.

12. The outcome of the reaction of US'304 in the light of Greenshields *et al.* and Crawford *et al.* was unexpected. I would have expected rather that *in situ* generation of peroxide would depolymerise hemicellulosic material, as had occurred with structurally similar lignin molecules in Crawford *et al.* In my opinion, the artisan of ordinary skill would also have expected depolymerisation of hemicellulosic material by *in situ* generation of peroxide.

13. I would also have expected, reading the materials and methods in US'403, that depolymerisation of hemicellulosic material by *in situ* generation of peroxide would occur because of the high levels of glucose/glucose oxidase used. I believe that the artisan of ordinary skill would likewise be surprised that the levels of oxidase and oxidase substrate did not depolymerise the hemicellulosic material of US'403.

14. The European patent application equivalent of Crawford *et al.* was published as EP0371712A2 on 6 June 1990, more than a year before the filing date of Greenshields *et al.* Even though I was aware of Crawford *et al.* when making the invention of Greenshields *et al.*, I chose in Greenshields *et al.* to add exogenous hydrogen peroxide and a peroxidase enzyme to produce a gelling effect of hemicellulose material. This was the preferred choice of polymerisation as there was no perceived danger of depolymerisation of phenolic-polysaccharide compounds that had been demonstrated in Crawford *et al.*

15. I believe that it would not be considered obvious to combine the teachings of Greenshields *et al.* and Crawford *et al.* which provide methods of polymerisation and depolymerisation, respectively. I also believe that the artisan of ordinary skill would be disinclined to combine the teachings of Greenshields *et al.* and Crawford *et al.*

B. The Teaching of Maat *et al.* and Geissman

16. Maat *et al.* describe the use of glucose oxidase as an ingredient in a bread improver to improve the quality of bread doughs in a similar fashion to that achieved by ascorbic acid, cysteine, lipoxygenase or bromate. These materials are well known to act through reaction with the wheat protein in dough rather than the polysaccharide fraction.

17. The technique in Maat *et al.* is a means of restoring the integrity of the dough through strengthening the protein components whilst allowing the desirable degradation of the polysaccharide components to yield improved crumb softness. Gelling of polysaccharides would not be likely in such a system, in part owing to the high levels of starch or protein which makes the composition as a whole insoluble in water.

18. The formulations described in Maat *et al.* also include xylanase. Xylanase would act to degrade any arabinoxylan gels in the system by catalysing the hydrolysis and depolymerisation of the polysaccharide chain.

19. I believe that it would not be possible to derive the invention of US'304 from the teaching of Maat *et al.* as that patent is directed to a different substrate and to achieving a different effect.

20. I, Roderick Greenshields, hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of the Title 18 of the United States Code.

9th September 2002
Date

Roderick Greenshields

On this 9 day of ~~August~~ September, 2002, appeared before me in person the above-named Roderick Greenshields and acknowledged the above to be his signature and that he signed, sealed and delivered the above statement as his voluntary act and deed.

Notary Public

[redacted]
147 ST. HELEN'S ROAD
SWANSEA
NOTARY PUBLIC